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I, KIM MARSHALL, MANAGER PATENT OPERATIONS hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. PP 7737 for a patent by SILVERBROOK RESEARCH PTY LTD filed on 16 December 1998.

WITNESS my hand this
Sixteenth day of November 1999

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AUSTRALIA

Patents Act 1990

PROVISIONAL SPECIFICATION

Applicant(s):

SILVERBROOK RESEARCH PTY LTD

Invention Title:

AN IMAGE CREATION METHOD AND APPARATUS (CEP02)

The invention is described in the following statement:

An Image Creation Method and Appartus (CeP02)

Field of the Invention

The present invention relates to printing system and, in particular, discloses an ink jet printing system utilizing a transfer roller.

Background of the Invention

With any high volume ink jet printing system which ejects ink onto paper, there is danger that, over time there can be a build up of paper fibres etc. which can be cause clogging of the ink jet printing system. Further, there is the danger that, should the printing system not be utilized for an extended period of time, the ink around the nozzles may dry out causing crustaceans etc. and again resulting in a blocking of the ink ejection nozzles. Further, there is often a need in ink jet printing systems to carefully control the placement of paper relative to the ink jet printing head so as to ensure proper registration. This often results in onerous mechanical requirements in high speed ink jet printing systems.

Summary of the Invention

It is an object of the present invention to provide an improved form of ink jet printing system.

In accordance with a first aspect of the present invention, there is provided a transfer roller printer comprising: a printhead unit including a pagewidth ink jet printhead; a transfer roller positioned adjacent the printhead and onto which ink is ejected by the printhead; an impression roller abutting the transfer roller for impressing the ink onto print media passed between the transfer roller and impression roller.

The printhead unit can be actuated to move from a capped state to a printing state such that, when in the capped state, the printhead can be substantially sealed from an exterior ambient atmosphere and when in the printing state, the printhead can be exposed to an exterior ambient atmosphere.

The printhead unit can be sealed against the

transfer roller when in a capped state. The printhead unit preferably can include at least one resiliently compressible sealing ring around the ink jet printhead, the ring being resiliently compressed against the transfer roller in a capped state.

The printhead unit further can comprise a solenoid coil initially activated utilizing a high current to move the printhead unit from the capped state to the printing state and maintaining the printhead unit in a printing state utilizing a second lower current.

The system can further include a transfer roller cleaning unit for cleaning the surface of the transfer roller after the impression of ink onto the print media.

The transfer roller cleaning unit preferably can include a series of cleaning sponges in contact with the surface of the transfer roller. The transfer roller can comprise a hollow cylinder. The cylinder preferably can include a titanium nitride coated surface. A driving means can be located within the hollow cylinder.

Brief Description of the Drawings

Notwithstanding any other forms which may fall within the scope of the present invention, preferred forms of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Fig. 1 illustrates a top plan view of the outer case in the preferred embodiment;

Fig. 2 illustrates a front plan view of the preferred embodiment;

Fig. 3 illustrates a side plan view of the allocation of the preferred embodiment;

Fig. 4 again illustrates a front plan view of the preferred embodiment;

Fig. 5 illustrates a top plan view showing the internal portions of the preferred embodiment;

Fig. 6 illustrates a first side plan view illustrating internal portions of the preferred embodiment;

Fig. 7 illustrates a second side plan view of the

internal portions of the preferred embodiment;

Fig 8 illustrates a close up side plan view of the transfer of roller printing system of the preferred embodiment;

Fig. 9 and Fig. 10 illustrate the printhead capping mechanism with the printhead cartridge in the parked and printing position respectively.

Description of Preferred and Other Embodiments

In the preferred embodiment, there is provided a front loadable printing system which includes a fully retractable paper supply and ink supply unit which also contains a page width printhead and transfer roller system for printing out images on demand. The preferred embodiment is designed to be rack mountable and integrated with other computer systems, such as internet type computer systems, set top boxes etc.

In Fig. 1, there is illustrated a top plan view of the preferred embodiment 1 with Fig. 2 illustrating a front plan view and Fig. 3 illustrating a side plan view. The preferred embodiment 1 is housed within a box and includes a front panel having an eject button 2, a power indicator 3 and an ink out light 4 and a paper out light 5. The paper is printed on and ejected out of the slot 6. The preferred embodiment is ideal for insertion is such products as televisions, hi-fidelity audio equipment, home theatre equipment, computer monitors, vehicles etc.

By means of depressing the eject button 2, access is provided to a tray for paper loading and ink cartridge replacement.

Turning now to Fig. 4 - Fig. 7, there is illustrated various views of the preferred embodiment with Fig. 4 showing another front plan view, Fig. 5 showing a top plan view, Fig. 6 showing a first side plan view and Fig. 7 showing a second side plan view. The preferred embodiment includes a paper store 8 which is of a similar construction to that provided with modern photocopiers and includes a plattern 9 and spring system 10 which

resiliently urges the paper within sheet feeder 8 against a series of pinch rollers 12, 13 which are attached to rod 14 which is driven by a cog mechanism 15 and motor 16. The pinch rollers 12, 13 forcing the paper forward where it is pinched between a roller 19 and a transfer belt 20 (Fig. 7) from which ink is deposited on the paper, as will be explained hereinafter, before the paper is ejected out of the printer slot (6 of Fig. 2).

A replaceable ink supply cartridge 22 can be "popped out" of the preferred embodiment when ink replacement is required. The ink supply cartridge provides four colors of ink including cyan, magenta, yellow and black 24 for supply to a printhead. The preferred embodiment is mounted on a cogged rail 25 along which it is able to move by means of electric motor 26 which is in a cogged wheel relationship with the rail 25. The operation of this system 25, 26 is similar to that provided by a CD ROM platter or video cassette tape ejection mechanisms well known in the art.

Turning now to Fig. 8, there is illustrated an enlarged view of the printing system. The printing system includes a roller 19 and transfer roller 20 which pinch paper 30 between them. The printing is done by a page width printhead 31 which is formed utilizing micro-electro mechanical techniques. Suitable printing devices include those disclosed in Australian Provisional Patent Specification PP6534 filed 16 October 1998, entitled "Micromechanical Device and Method (IJ46A)" filed by the present applicant, the contents of which are hereby specifically incorporated by cross-reference. The printhead 31 is encased in a printhead moulding which is of a generally semi-circular cross section around which an outer surface includes an ink filter mesh 33. The printhead moulding is inserted in a plastic cartridge extrusion 34 which has 4 color channels defined therein which are normally filled with ink.

An inner surface of the printhead moulding 32

includes a series of printed elastomeric seals 36 which surround the printhead 31. In Fig. 8, the printhead unit is shown in a printing position. Fig. 9 illustrates the printer in a parked position when not in use with Fig. 10 by way of contrast, showing the printhead in a printing position. It can be seen that significant difference between the two is that the cartridge 34 moves away from the transfer roller 20 when printing. When idle, the elastomeric seals 36 abut the transfer roller providing a total seal around the printhead thereby reducing the opportunities for the printer to dry out.

The cartridge 34 is moved through the utilization of a solenoid device 40 which includes an elongated electric coil and surrounding a ferromagnetic unit. Upon energising the coil, the metal keeper 41 is forced to move into close proximity for use of the solenoid 40 thereby forcing the cartridge 34 to move away from the surface of the transfer drum 20. It will be evident that initially a high current is needed to move the metal keeper 41. However, subsequently, a much lower keeper current (approximately one hundredth of the size) is required to keep the cartridge 34 closely adjacent to the solenoid 40. Electronic control is provided to the printhead 32 by means of a flexible tape automated bonded (TAB) film 44 which raps around a surface of the cartridge extrusion 34. Power is supplied to the tab film 44 by means of power and ground busbars eg. 45.

The ink is ejected from the printhead 31 and deposited on the transfer roller 20. The transfer roller 20 rotates by a series of internal motors and gears 47 and eventually makes contact with the paper 30 so as to deposit the ink thereon. After the ink is deposited, the transfer roller 20 is cleaned by means of cleaning the sponge 49 which sits within a cleaning extrusion 48. The transfer roller also undergoes final cleaning by means of wiper blade 50. It will be evident that, through the provision of the transfer roller 47 and cleaning system eg. 49, 50

any paper fibres and excess material is unlikely to collect near printhead 31 and, as a result, there is a reduced likelihood of clogging of the printhead 31 due to excess fibres or other debris.

The printhead 31 is preferably of the high resolution, say 1600dpi, printing standard A4, letter sized pages at approximately 30 pages per minute. The print time can be as low as 2 seconds and the printhead 31 can include approximately 54,400 nozzles with 13,600 nozzles per color.

The transfer roller 20 can comprise a steel or aluminium cylinder with a titanium nitride CVD coating so as to provide for a light weight, long term operation. A series of ink supply channels or pipes can be provided at one end of the printing cartridge for interconnection with the ink supply cartridge 24. In this manner, a high speed transfer roller type printhead is provided having advantages of transfer roller operating characteristics. Further, the printing system provides for a total front end loading apparatus suitable for installation in the aforementioned devices.

It would be appreciated by a person skilled in the art that numerous variations and/or modifications may be made to the present invention as shown in the specific embodiment without departing from the spirit or scope of the invention as broadly described. The present embodiment is, therefore, to be considered in all respects to be illustrative and not restrictive.

We Claim:

1. A transfer roller printer comprising:

a printhead unit including a pagewidth ink jet printhead;

a transfer roller positioned adjacent said printhead and onto which ink is ejected by said printhead;

an impression roller abutting said transfer roller for impressing said ink onto print media passed between said transfer roller and impression roller.

2. A transfer roller printer as claimed in claim 1 wherein said printhead unit is actuated to move from a capped state to a printing state such that, when in said capped state, the printhead is substantially sealed from an exterior ambient atmosphere and when in said printing state, said printhead is exposed to an exterior ambient atmosphere.

3. A transfer roller printer as claimed in claim 2 wherein said printhead unit is sealed against said transfer roller when in a capped state.

4. A transfer roller printer as claimed in claim 2 wherein said printhead unit includes at least one resiliently compressible sealing ring around said ink jet printhead, said ring being resiliently compressed against said transfer roller in a capped state.

5. A transfer roller printer as claimed in claim 2 wherein said printhead unit further comprises a solenoid coil initially activated utilizing a high current to move said printhead unit from said capped state to said printing state and maintaining said printhead unit in a printing state utilizing a second lower current.

6. A transfer roller printer as claimed in any previous claim further comprising a transfer roller cleaning unit for cleaning the surface of said transfer roller after the impression of ink onto said print media.

7. A transfer roller printer as claimed in claim 6 wherein said transfer roller cleaning unit includes a series of cleaning sponges in contact with the surface of

said transfer roller.

8. A transfer roller printer as claimed in any previous claim wherein said transfer roller comprises a hollow cylinder.

9. A transfer roller printer as claimed in claim 8 wherein said cylinder includes a titanium nitride coated surface.

10. A transfer roller printer as claimed in claim 8 further comprising a driving means located within said hollow cylinder.

11. A transfer roller printer as claimed in any previous claim wherein said printhead supply unit supplies ink to said printhead via a back surface of said printhead.

Abstract

A transfer roller printer comprising: a printhead unit including a pagewidth ink jet printhead; a transfer roller positioned adjacent the printhead and onto which ink is ejected by the printhead; an impression roller abutting the transfer roller for impressing the ink onto print media passed between the transfer roller and impression roller. The printhead unit can be actuated to move from a capped state to a printing state such that, when in the capped state, the printhead can be substantially sealed from an exterior ambient atmosphere and when in the printing state, the printhead can be exposed to an exterior ambient atmosphere. The printhead unit can be sealed against the transfer roller when in a capped state. The printhead unit preferably can include at least one resiliently compressible sealing ring around the ink jet printhead, the ring being resiliently compressed against the transfer roller in a capped state. The printhead unit further can comprise a solenoid coil initially activated utilizing a high current to move the printhead unit from the capped state to the printing state and maintaining the printhead unit in a printing state utilizing a second lower current. A transfer roller cleaning unit for cleaning the surface of the transfer roller after the impression of ink onto the print media.

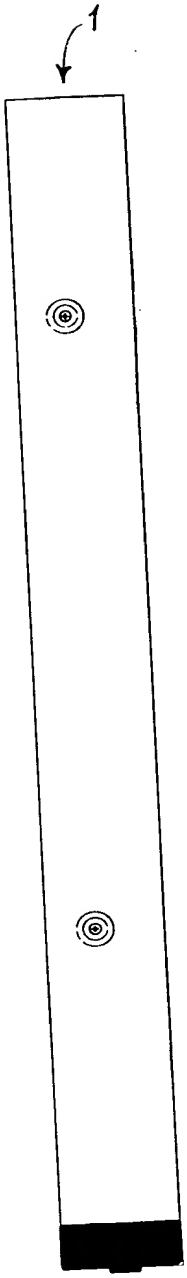


FIG. 3

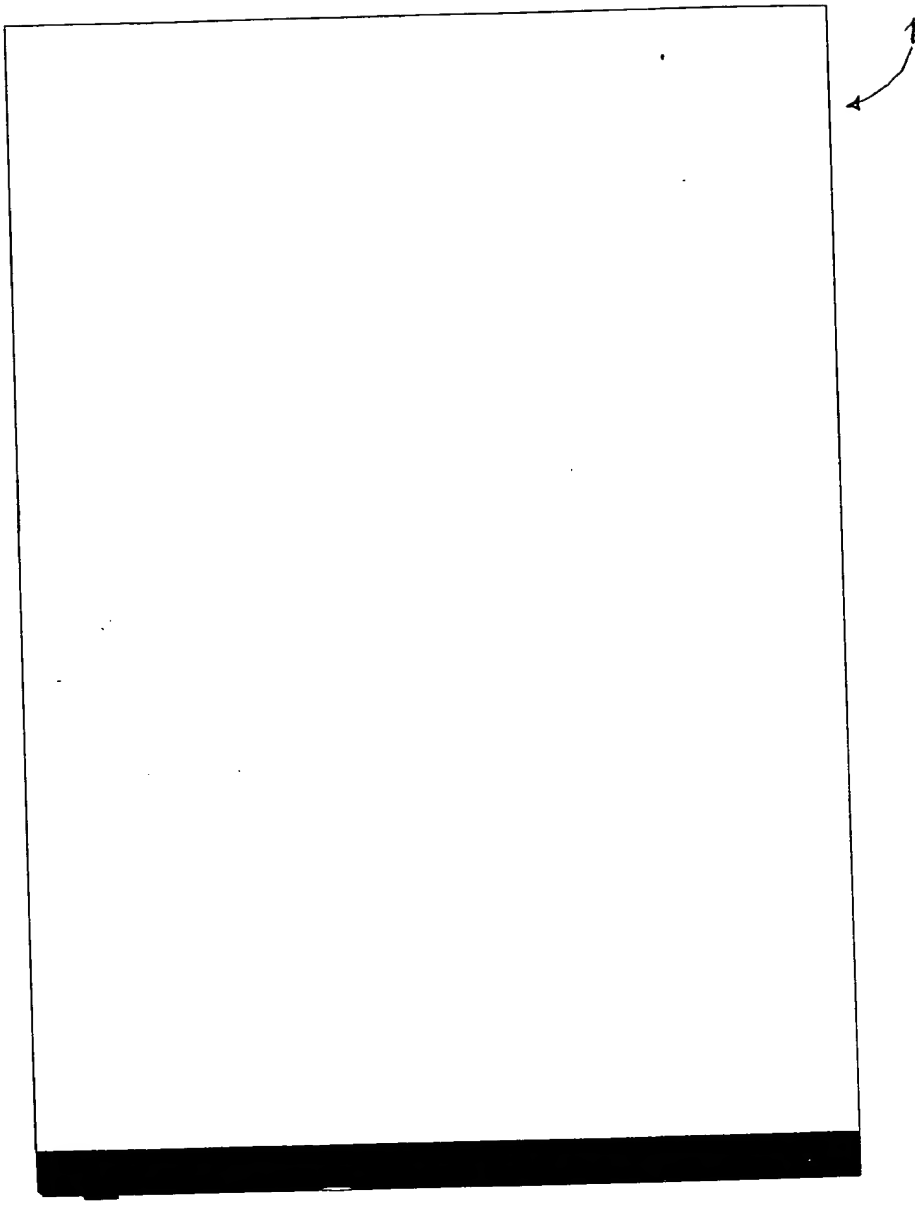


FIG. 1

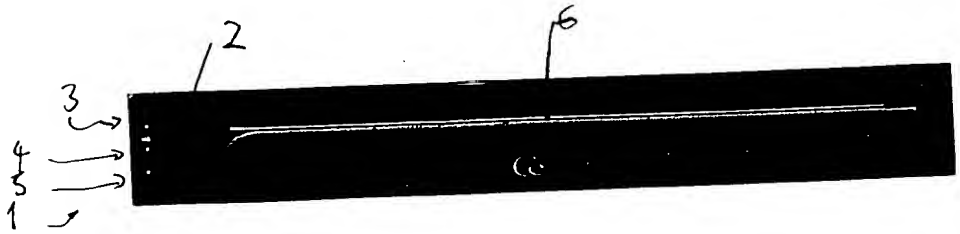


FIG. 2

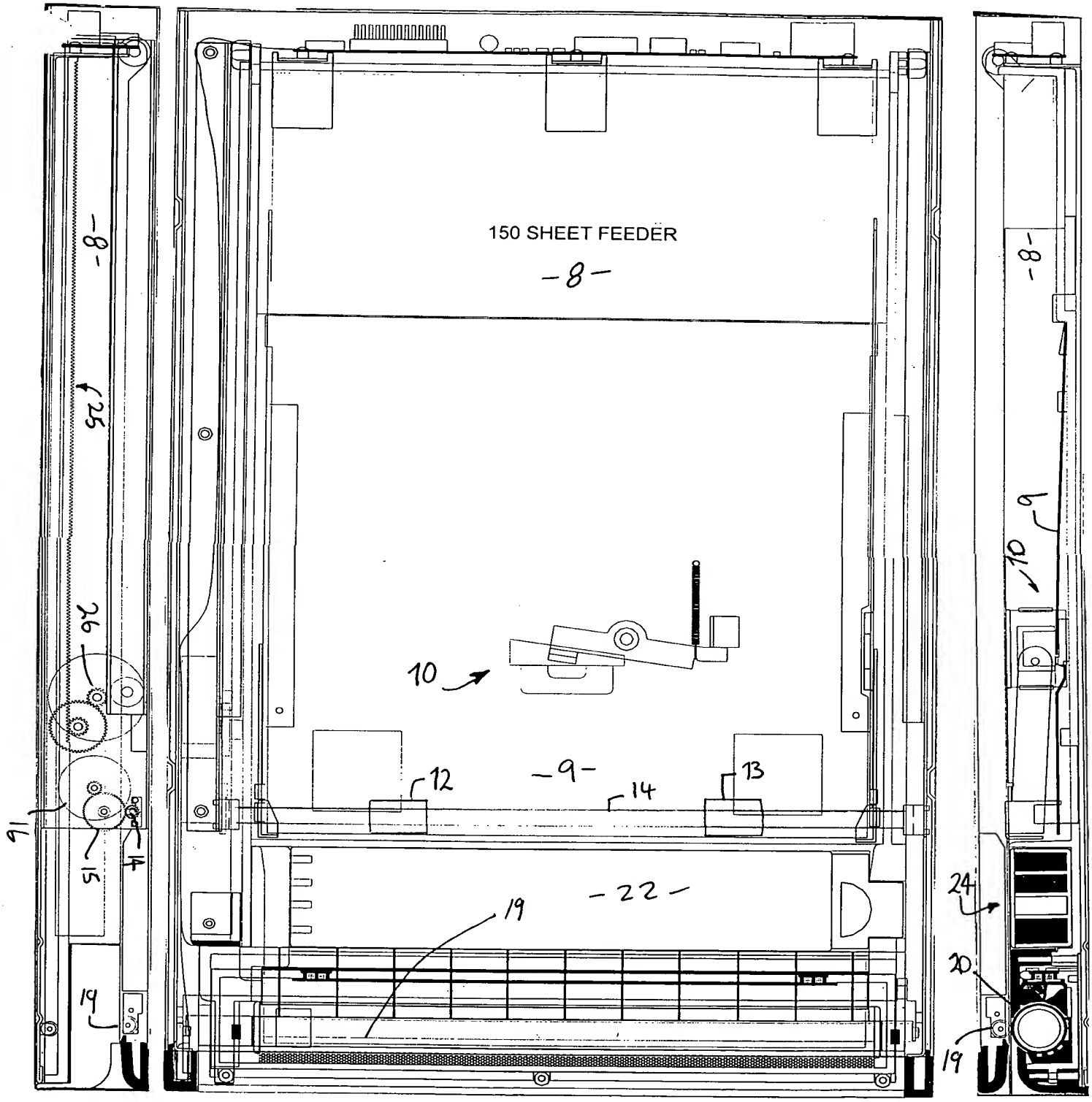


FIG. 6 FIG. 5 FIG. 7

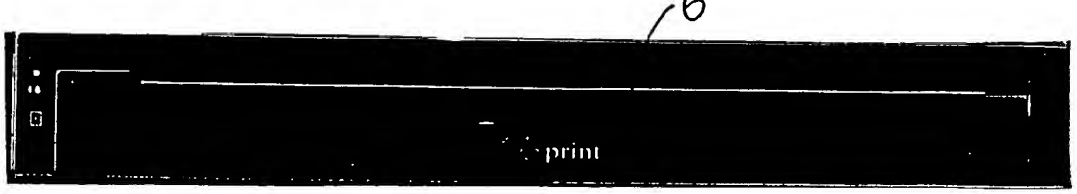
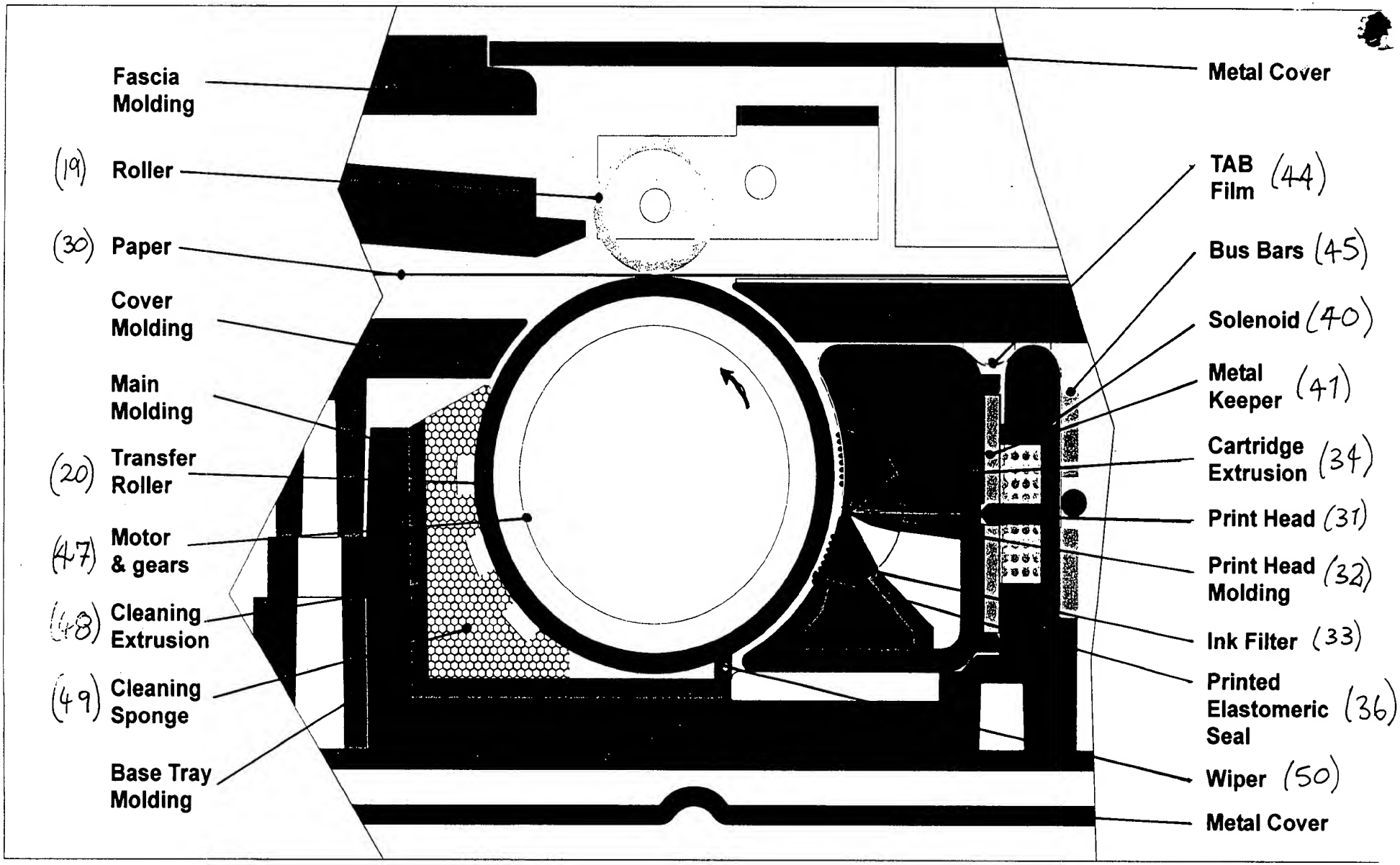


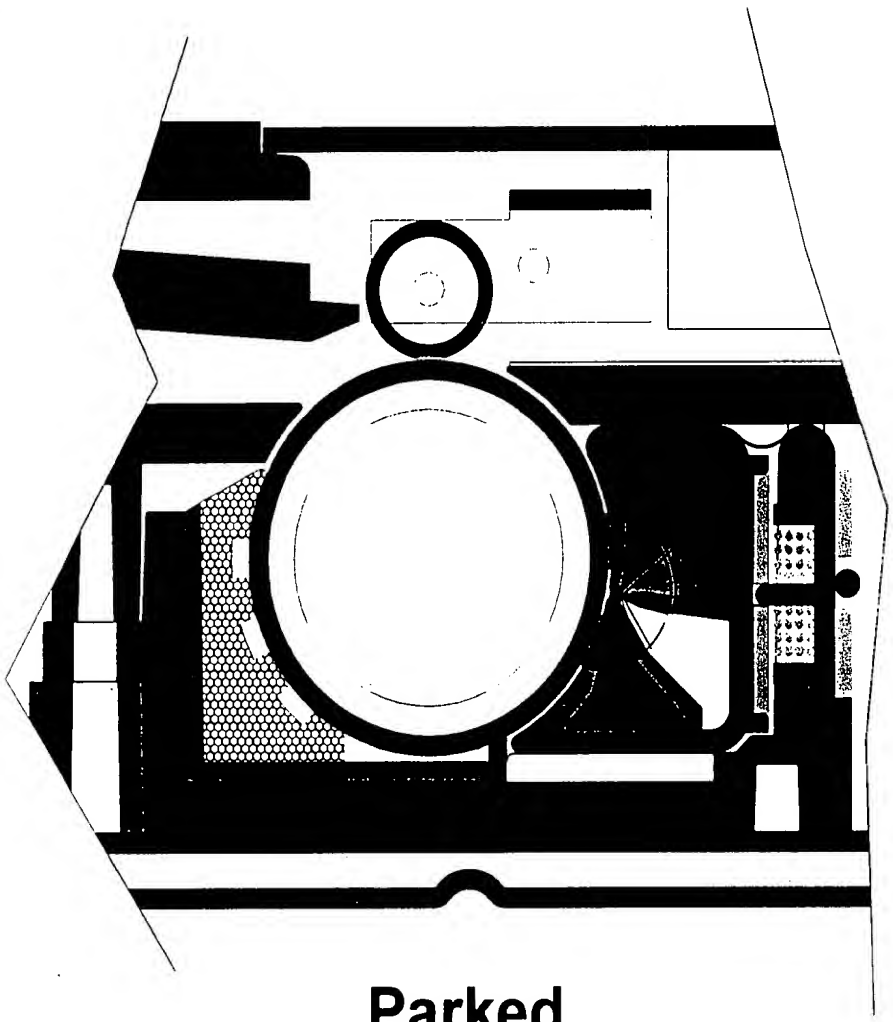
FIG. 4



Print Head Assembly

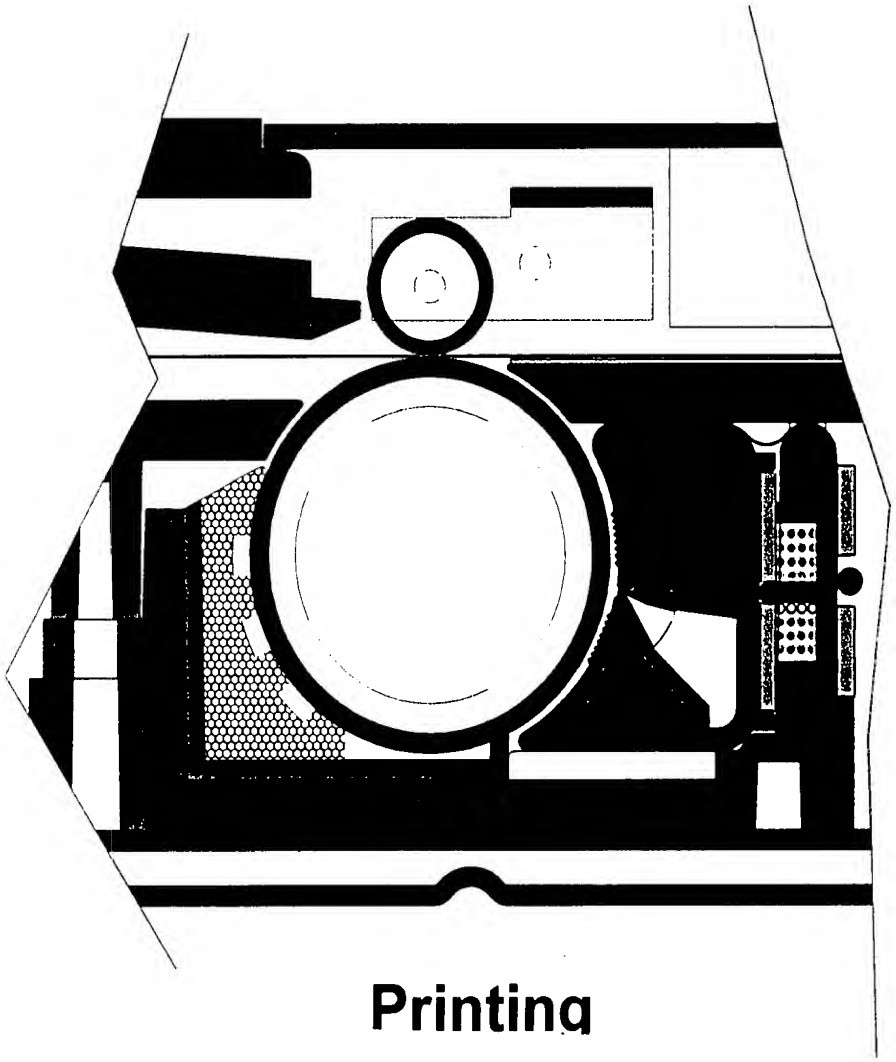
0 10mm 20mm

FIG. 8



Parked

FIG. 9



Printing

FIG. 10

Print Head Operation